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changed, but the cells of the inner one proliferate and begin to lay down the shell, which may be distinguished in sections as a very thin lamina. At about this time observations of embryos by reflected light show a small invagination or hole near the center of the newly formed shell, which is thus laid bare. The hole then is of secondary formation and not, as Korschelt supposes, something that has persisted from the original invagination.

It appears then that the internal formation of the shell, as it has been generally recognized in the so called naked pulmonates is not an exception to a rule but the rule itself, and that the condition obtaining in *Limax* and others differs from that in the rest of the pulmonates only in so far as a rudimentary condition is retained in the adult animal.—F. C. KENYON, Ph. D., Clark University, Worcester, Mass.

PSYCHOLOGY.

Physical and Social Heredity.—The great courtesy of the Editor of this journal in reprinting one of my paper from *Science* preliminary to replying to it encourages me to ask him for a page or two of comment on his reply. This is the more needful since the second of my papers which he criticises may not have been seen by the readers of the *NATURALIST*, and the third has only just appeared in *Science*, (March 20 and April 10, 1896).

The main question at issue is the relation of consciousness or intelligence to heredity; the other matter, that of the relation of consciousness to the brain, being so purely speculative that I shall merely touch upon it at the end of this note.

Prof. Cope¹ says: "there is no way short of supernatural revelation by which mental education can be accomplished other than by contact with the environment through sense-impressions, and by transmission of the results to subsequent generations. The injection of consciousness into the process does not alter the case, but adds a factor which necessitates the progressive character of evolution." Both of these sentences I fully accept, except that the word "transmission" seem to imply the Lamarckian factor, which I think the presence of consciousness renders unnecessary. Using the more neutral word "conservation" instead of "transmission," I may refer to three points on which Prof. Cope criticises my views: first, conservation of intelligent acquisitions from genera-

¹ AMER. NAT., April, 1896, p. 343.

tion to generation ; second, " the progressive character of evolution ; " and third, " mental education " or acquisition.

First, agreeing as we do on the fact of mental acquisition or " selection through pleasure, pain, experience, association, etc.," Prof. Cope cites my second paper (*Science*, Mar. 20th) in which I hold that consciousness makes acquisitions of new movements by such selections. He then says, if so, then I admit the Lamarkian factor. But not at all ; it is just the point of my article to refute Romanes by showing that adaptation by intelligent selection makes the Lamarkian factor unnecessary. And in this way, i. e., this sort of adaptation on the part of a creature *keeps that creature alive* by supplementing his reflex and instinctive actions, so *prevents the operation of natural selection* in his case, and gives the species time to get congenital variations in the lines that have thus proved to be useful (see cases cited). Farthermore, all the resources of Social Heredity—the handing down of intelligent acquisition by maternal instruction, imitation, gregarious life, etc.—come in directly to take the place of the physical inheritance of such adaptations. This influence Prof. Cope, I am glad to see, admits ; although in admitting it, he does not seem to see that he is practically throwing away the Lamarkian factor. For instead of limiting this influence to human progress, we have to extend it to all animals with gregarious and family life, to all creatures that have any ability to imitate, and finally to all animals which have consciousness sufficient to enable them to make conscious adaptations themselves : for such creatures will have children that do the same, and it is unnecessary to say that the children must inherit what their fathers did by intelligence, when they can do the same things by their own intelligence. As a matter of fact Prof. Cope is exactly the biologist to whose Lamarkism this admission is, so far as I can see, absolutely fatal ; for he more than all others holds that adaptations all through the biological scale are secured by consciousness.² If so, then he is just the man who is obliged to extend to the utmost the possibility of the transmission also of these adaptations by intelligence, which, as I said, rules out the need of their transmission by physical heredity. At any rate he is quite incorrect in saying that " he [I] both admit and deny Lamarkism."

To this argument of mine Prof. Cope presents no objection that I see except one from analogy. He says : " I do not see how promiscuous variation and natural selection alone can result in progressive psychic evolution, more than in structural evolution, since the former is condi-

² And in this I think he is right : see chaps. VII and IX of my *Mental Development* (Macmillans, 2d. ed.).

tioned by the latter." As to the word "progressive," I take up that question below; but as to the analogy with structural evolution, two answers occur to me. In the first place, Prof. Cope is, as I said, the very man who holds that all structural evolution is secured by direct conscious adaptations. He says: "mind determines movements and movements have determined structure or form." If this be true how can psychic be conditioned by structural evolution? Would not rather the structural changes depend upon the psychic ability of the creature to effect adaptations? And then, second, at this point Prof. Cope assumes the Lamarkian factor in structural evolution. Later on he makes the same assumption when he says: "But since the biologists have generally repudiated Weismannism," etc. This is a curious saying; for my impression is that even on the purely biological side, the tendency is the other way. Lloyd Morgan has pretty well come over; Romanes took back before he died many of his arguments in favor of the Lamarkian factor; and here comes a paleontologist, Prof. Osborn, —if he is correctly reported in *Science*, April 3rd, p. 530—to argue against Prof. Cope on this very point with very much the same sort of argument as this which I have made.³ And while Prof. Cope will agree with me that this sort of *argumentum ex autoritate* is not very convincing, yet he will not object to my balancing off his dictum with the following from a letter which just comes to me from another distinguished biologist, Prof. Minot: "Neo-Lamarkism seems to me an impossible theory."

But Prof. Cope goes on to say that I "both admit and deny Weismannism;" on the ground that "his [my] denial of inheritance only covers

³ Since writing this I have heard Prof. Osborn read a paper which confirms the agreement between him and me which I supported in the text above. I reached my conclusion independently and one of my *Science* articles gives report of it as expressed in a criticism of Romanes before the New York Academy of Science on Jan. 31st, 1896. Prof. Osborn's expression "ontogenic variations" i. e. those brought out by "environment (which includes all the atmospheric, chemical, nutritive, motor, and psychical circumstances under which the animal is reared)" seems to make these adaptations after all *constitutional*. As Prof. Osborn says this will not do for all cases; and I think it will not do for instinct, where constitutional variations without the aid of *intelligence* would never suffice (as Romanes says) to keep the animal alive while correlated variations are being perfected phylogenically. But it seems to answer perfectly where intelligent or other adaptations supplement the constitutional variations—and that is just the point made in my *Science* paper. As to the way these ontogenic variations or adaptations are brought about in the individual creature, see the remarks on "organic selection" below. I am printing in the next issue of this journal (June) a full statement of the entire position.

the case of psychological sports." But I do not see the connection. If Prof. Cope means denial of the inheritance of acquired characters then I deny it equally of sports and other creatures; but I do not deny that the native "sportiveness" (!) of sports tends to be transmitted. In my view the "massiveness of front" which progress shows (and which Prof. Cope accepts) shows that in social transmission the individual is usually swamped in the general movement as the individual sport is in biological progress. As a matter of fact, however, the analogy from "sports" which Prof. Cope makes does not strictly hold. For the social sport, the genius, is *sometimes* just the controlling factor in social evolution. And this is another proof that the means of transmission of intelligent adaptations is not physical heredity alone, but that they are socially handed down. I do not see, therefore, what Prof. Cope means by saying that I "admit and deny Weismannism," for I have never discussed Weismannism at all. I believe in the Neo-Darwinian position plus some way of getting "determinate variations." And for this latter I think the way now suggested is better than the Lamarkian way. Like many of the biologists (e. g., Minot) I see no proof of Weismannism (just as I protest mildly against being sorted with Mr. Benjamin Kidd!); yet I have no competence for such purely biological speculations as those which deal in plasms!

Second, the question as to how evolution can be made "progressive." Prof. Cope thinks only by the theory of "lapsed intelligence" or "inherited habit." Admitting that the intelligence makes selections, then they must be inherited, in order that the progress of evolution may set the way the intelligence selects. But suppose we admit intelligent selection (even in the way Prof. Cope believes); still there are two influences at work to keep the direction which the intelligence selects apart from the supposed direct inheritance. There is that of social handing down, imitation, etc., or Social Heredity, which I have already pointed out; and besides there is the survival by natural selection of those creatures which have variations which intelligence can use. This puts a premium on these variations and their intelligent use in following generations. Suppose, for instance, a set of young animals some of which have variations which intelligence can use for a particular adaptation, thus keeping these individuals alive, while the others who have not these variations die off; then the next generation will not only have the same variations which intelligence can use in the same way, but will also have the intelligence to use the variations in the same way, and the result will be about *the same as if the second generation had inherited the adaptations directly*. The direc-

tion of the intelligent selection will be preserved in just the same sense. I think it is a great feature of Prof. Cope's theory that he emphasizes the intelligent direction of evolution, and especially that he does it by appealing to the intelligent adaptations of the creatures themselves; but just by so doing he destroys the need of the Lamarckian factor. Natural selection kills off all the creatures which have not the intelligence nor the variations which the intelligence can use; those are kept alive which have both the intelligence and the variations. They use their intelligence just as their fathers did, and besides get new intelligent adaptations, thus aiding progress again by intelligent selection. What more is needed for progressive evolution?⁴

Third. We come now to the third point—the method of intelligent selection—and on this point Prof. Cope does not understand my position, I think. I differ from him both in the psychology of voluntary adaptations of movement, and in the view that consciousness is a sort of force directing brain energies in one way or another (for nothing short of a force could release or direct brain energy). The principle of Dynamogenesis was cited in my article in this form: i. e., "the thought of a movement tends to discharge motor energy into the channels as near as may be to those necessary for that movement." This principle covers two facts. First, that no movement can be thought of effectively which has not itself been performed before and left traces of some sort in memory. These traces must come up in mind when its performance is again intended. And second (and in consequence of this) that no act, whatever, can be performed by consciousness by willing movements which have never been performed before. It follows that we can not say that consciousness by selecting new adaptations beforehand can make the muscles perform them. The most that psychologists (to my knowledge) are inclined to claim is that by the attention one or other of alternative movements which have been performed before (or combinations of them) may be performed again; in other words, the selection is of old alternative movements. But this is not what Prof. Cope seems to mean; nor what his theory requires. His theory requires the acquisition of new movements, *new adaptations to environment*, by a conscious selection of certain movements which are *then carried out the first time* by the muscles.⁵

⁴ I keep to "intellegent" adaptations here; but the same principle applies to *all adaptations made in ontogenesis*. I am using the phrase "Organic Selection" in the article to appear in this journal to designate this "factor" in evolution (see the next heading below).

⁵ "Conscious states do have a causal relation to the other organic processes." I do not find, however, that Prof. Cope has made clear just how in his opinion the "selection" by consciousness does work.

It may very justly be asked; if his view be not true, how then can new movements which are adaptive ever be learned at all? This is one of the most important questions, in my view, both for biologists and for psychologists; and my recent work on *Mental Development* is, in its theoretical portion (chap., VIIff), devoted mainly to it, i. e., the problem of *ontogenetic accommodation*. I can not go into details here, but it may suffice to say that Spencer (and Bain after him) laid out what seems to me, with certain modifications urged in my book, the only theory which can stand in court. Its main thought is this, that all new movements which are adaptive or "fit" are selected from *overproduced movements* or *movement variations*, just as creatures are selected from overproduced variations by the natural selection of those which are fit. This process, as I conceive it, I have called "organic selection," a phrase which emphasizes the fact that it is the organism which selects from all its overproduced movements those which are adaptive and beneficial. The part which the intelligence plays is "through pleasure, pain, experience, association, etc., to concentrate the energies of movement upon the limb or system of muscles to be used and to hold the adaptive movement, "select" it, when it has once been struck. In the higher forms both the concentration and the selection are felt as acts of attention.

Such a view extends the application of the general principle of selection through fitness to the *activities of the organism*. To this problem I have devoted some five years of study and experiment with children, etc., and I am now convinced that this "organic selection" bears much the same relation to the doctrine of special creation of ontogenetic adaptations by consciousness which Prof. Cope is reviving, that the Darwinian theory of natural selection bears to the special creation theory of the phylogenetic adaptations of species. The facts which Spencer called "heightened discharge" are capable of formulation of the principle of "motor excess": "the accommodation of an organism to a new stimulation is secured—not by the selection of this stimulation beforehand (nor of the necessary movements)—but by the reinstatement of it by a discharge of the energies of the organism, concentrated, as far as may be, for the excessive stimulation of the organs (muscles, etc.), most nearly fitted by former habit to get this stimulation again,"⁶ in which the word "stimulation" stands for the condition favorable to adaptation. After several trials with grotesquely excessive movements, the child (for example) gets the adaptation aimed at more and more perfectly, and the accompanying excessive and use-

⁶ *Mental Development*, p. 179. Spencer and Bain hold that the selection is of purely chance adaptations among spontaneous random movements.

less movements fall away. This is the kind of "selection" that consciousness does in its acquisition of new movements. And how the results of it are conserved from generation to generation, without the Lamarkian factor, has been spoken of above.

Finally, a word merely of the relation of consciousness to the energies of the brain. It is clear that this doctrine of selection as applied to muscular movement does away with all necessity for holding that consciousness even directs brain energy. The need of such direction seems to me to be as artificial as Darwin's principle showed the need of special creation to be for the teleological adaptations of the different species. This necessity of supposed directive agency done away in this case as in that, the question of the relation of consciousness to the brain becomes a metaphysical one; just as that of teleology in nature became a metaphysical one; and science can get along without asking it. And biological as well as psychological science should be glad that it is so—should it not?

I may add in closing that of the three headings of this note only the last (third) is based on matters of my private opinion; the other two rest on Prof. Cope's own presuppositions—that of intelligent selection in his sense of the term, and that of the bearing of Social Heredity (which he admits) upon Lamarckism. In another place I hope to take up the psychology of Prof. Cope's new book in some detail.

J. MARK BALDWIN.

Observations on Prof. Baldwin's Reply.—In order to comprehend the question at issue, it is necessary to state certain fundamental principles of evolution. This process consists in the development of the heterogeneous from the homogeneous as Spencer expresses it; or in more specific language, evolution consists in the development of specialized structures from generalized material. Primitive organic or living beings consist of protoplasm which is, as compared with higher organisms, generalized. That is, they are without distinct muscular, nervous, or digestive organs, etc. How are psychic conditions related to this process of specialization? Prof. Baldwin states that an animal is able to "select through pleasure, pain, experience, association, etc., from certain alternative complex movements which are already possible for the limb or member used." This means that under guidance of a form of consciousness, certain existing muscles are selected to perform certain movements, while other muscles are neglected. Now if this be possible to a muscular system specialized into discrete bundles, it is also possible to a primitive contractile protoplasm which is not yet differ-

entiated into discrete muscular and other bodies. In other words it is possible to contract that part of the homogeneous protoplasm which is necessary for the production of a certain movement, and leave that part of the protoplasm which is not necessary to produce the movement, uncontracted. And this is exactly what undifferentiated animals (Protozoa) do, and it is what is done at all stages of differentiation of the muscular system, so far as the differentiation which that muscular system has attained, will permit. It is the sentence which I have quoted above from Prof. Baldwin which induced me to say that he admits the Lamarckian factor. For there is no doubt that it has been this habitual contraction of certain parts of undifferentiated protoplasm which has produced muscular bands, sheets, etc., as distinguished from other histological elements of the organism. If this be true, there is no necessity for the hypothesis of "overproduced movements" as the source of new habits, since those habits may be produced by the direct effect of the selective power of the animal over its own protoplasm. It is not intended by this expression to claim anything more than simple sensation for simple forms of life, or that anything higher than hunger, reproduction temperature, etc., constitute their pleasures and pains.

The theory of natural selection from "overproduced movements" as a *source* of new movements stands on the same basis as all the other theories of natural selection as explanations of the *origin* of anything new. They are impossible in practice, and inaccurate in logic, since in my opinion, following that of Mr. Darwin, they demand of Natural Selection a function of which it is by its definition incapable. That natural selection regulates the survival of movements after they have originated, goes without saying. It is evident that "overproduced movements" must on Prof. Baldwin's "Organic Selection" theory, include the adaptive one which is destined to survive. The question then is as to the origin of this particular "overproduced" and adaptive movement. The explanation has been given above; i. e. that it is a direct response to the stimulus supplied. The location in the organism of the responsive movement depends on the location of the stimulus, a fact testified to by the close local connection of motor with sensory nerves of general sensation. In the case of responses to special sensation, we may suppose that the responses only became exact as to locality after a period of trial and error, the new movement always having a local relation to the point of stimulus. The beast bites his wound, before he has traced the pain to his enemy. As already pointed out, this process would result in a perfected mechanism which would be inherited. No one can yet explain the mechanism of the control of a mental state

over a contraction of protoplasm. It is one of the ultimate facts of the universe. When Prof. Baldwin admits that an animal can select which of two muscles it will use, or when he admits that an animal can contract any muscle under the stimulus of "pleasure, pain, etc., he admits this ultimate fact, but does not explain it.

As to the scope of Social Heredity as a factor in psychic evolution, it appears to me to be, like that of the higher intelligence, mainly restricted to the higher animals and to man. Maternal instruction among all but the higher animals probably has no existence. Imitation may be supposed to be possible to animals a little lower in the scale. But both factors are to my mind only supplementary to the more vigorous education furnished by the environment, with its wealth of stimuli to "pleasure, pain, experience, association, etc." In regarding Social Heredity as the sole factor of psychic evolution, Prof. Baldwin temporarily loses sight of the intimate connection between mind and its physical basis. The inheritance of mental characteristics is as much a fact as the inheritance of physical structure, and for the reason that the two propositions are identical. One does not believe in either education or imitation as a cause of the repetition of insanity in family lines. We rather believe in a defective brain mechanism, which is inheritable, though fortunately not always inherited. The doctrine of Weismann that acquired characters are not inherited, if true, would furnish the physical conditions for the theory that Social Heredity is the only psychic heredity, but it is impossible to believe that Weismann's doctrine is true. Hence while Social Heredity is true as far as it goes, Lamarkism is also true, and expresses the more fundamental law. The fact that no adequate physical explanation of the inheritance of acquired characters has been reached does not disprove the fact.

E. D. COPE.

ANTHROPOLOGY.¹

Indian habitation in the Eastern United States.—Mr. Thomas Wilson of the Smithsonian Institution in a recent letter referring to a discussion in Washington as to the shape of Indian habitations east of the Mississippi, says, that while certain of the disputants "agreed that the Plains Indians of the present or modern times used wigwams made with poles fastened together at the top and spreading out in a circle at the bottom after the fashion of a Sibley tent, they

¹This department is edited by Henry C. Mercer, University of Penna., Phila.